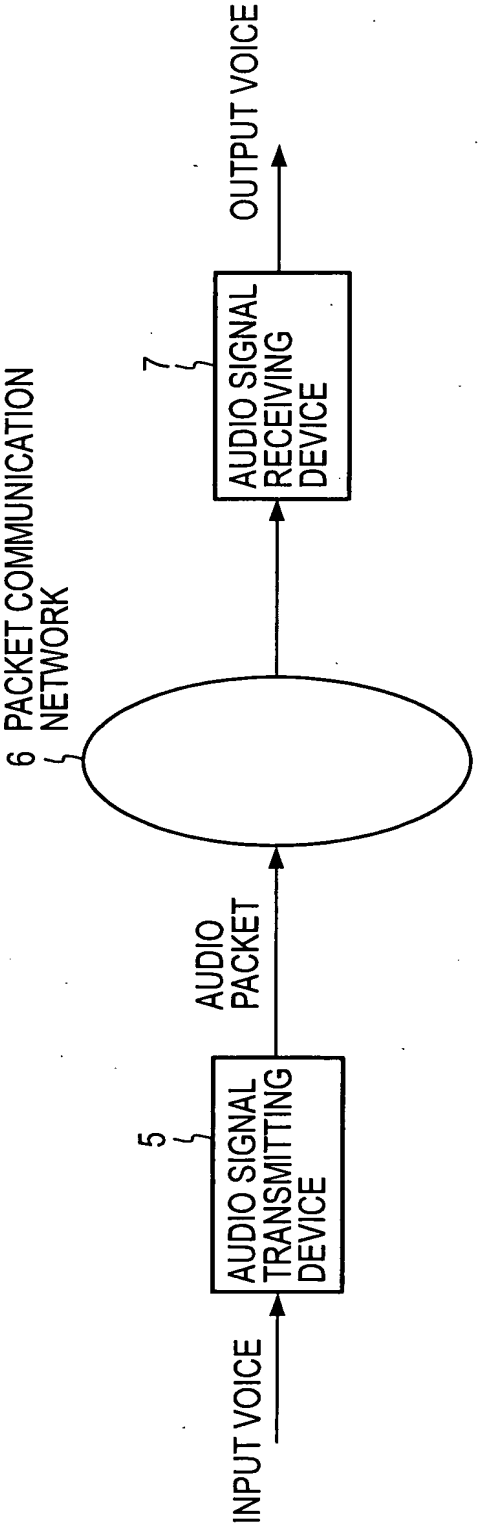

INPUT VOICE
5
AUDIO SIGNAL TRANSMITTING DEVICE
AUDIO PACKET
6 PACKET COMMUNICATION NETWORK
7
AUDIO SIGNAL RECEIVING DEVICE
OUTPUT VOICE

FIG. 1

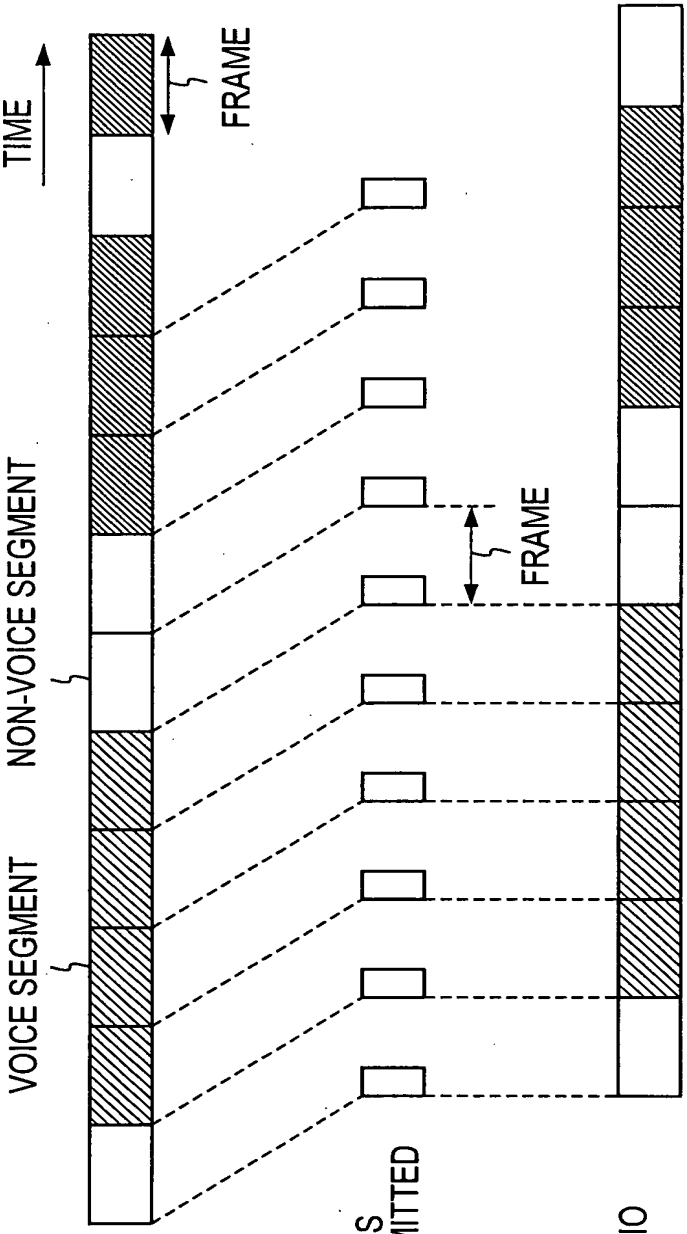


FIG. 2A

FIG. 2B

FIG. 2C

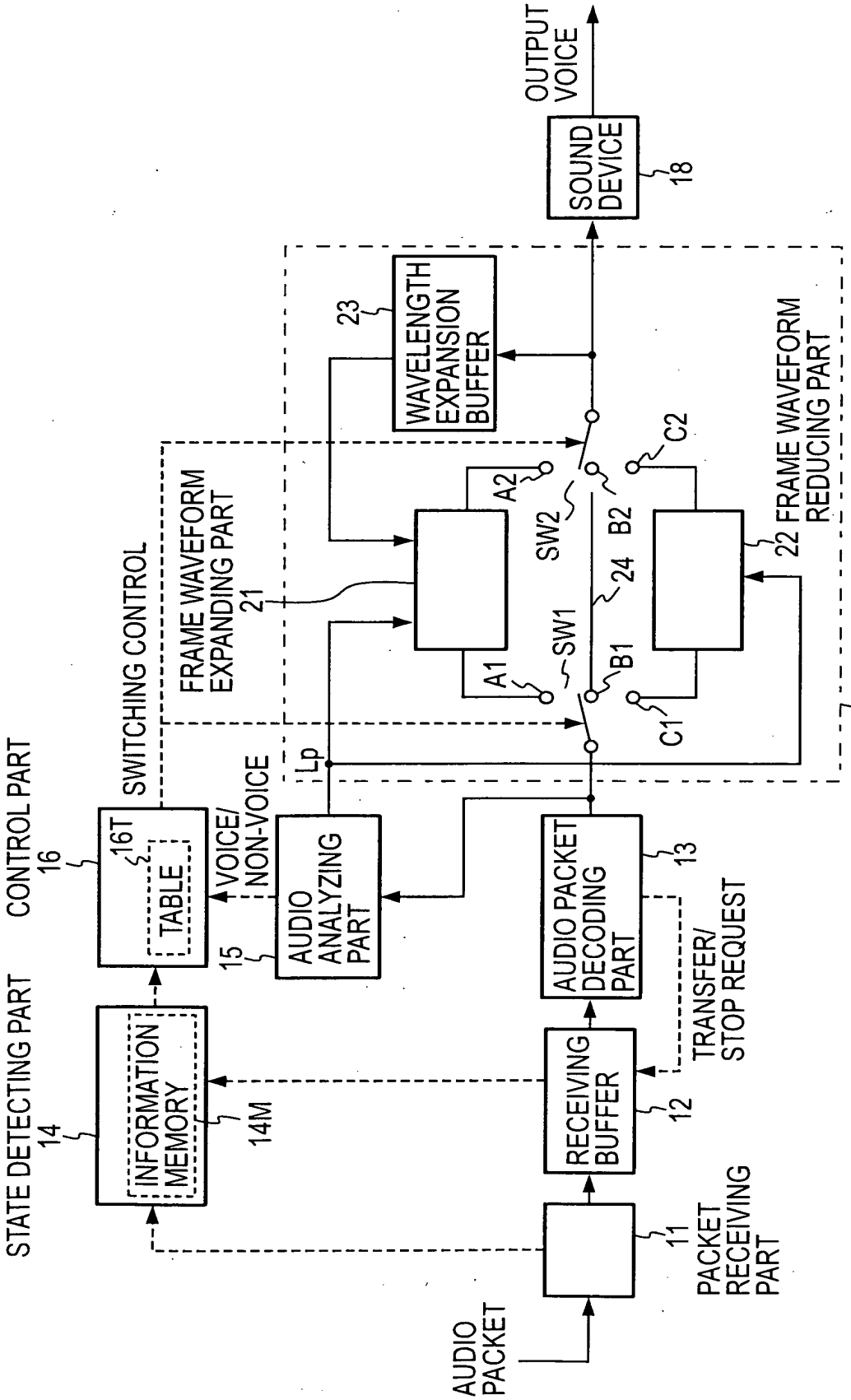

AUDIO PACKET
PACKET RECEIVING PART
11
RECEIVING BUFFER
12
TRANSFER/ STOP REQUEST
AUDIO PACKET DECODING PART
13
STATE DETECTING PART
14
INFORMATION MEMORY
14M
CONTROL PART
16
16T
TABLE
SWITCHING CONTROL
VOICE/ NON-VOICE
15
AUDIO ANALYZING PART
Lp
FRAME WAVEFORM EXPANDING PART
21
A1
A2
SW1
SW2
B1
B2
C1
C2
24
WAVELENGTH EXPANSION BUFFER
23
FRAME WAVEFORM REDUCING PART
22
20 CONSUMPTION ADJUSTING PART
SOUND DEVICE
18
OUTPUT VOICE

FIG. 3

TABLE 16T

LARGEST JITTER J	OPTIMUM NUMBER OF PACKETS B TO BE BUFFERED
TO 15ms	1
TO 32ms	2
TO 48ms	3
TO 64ms	4
TO 80ms	5
TO 96ms	6
TO 128ms	8
TO 160ms	10
TO 192ms	12
TO 240ms	15
TO 320ms	20
TO 400ms	25
TO 480ms	30
TO 640ms	40
TO 800ms	50

FIG. 4

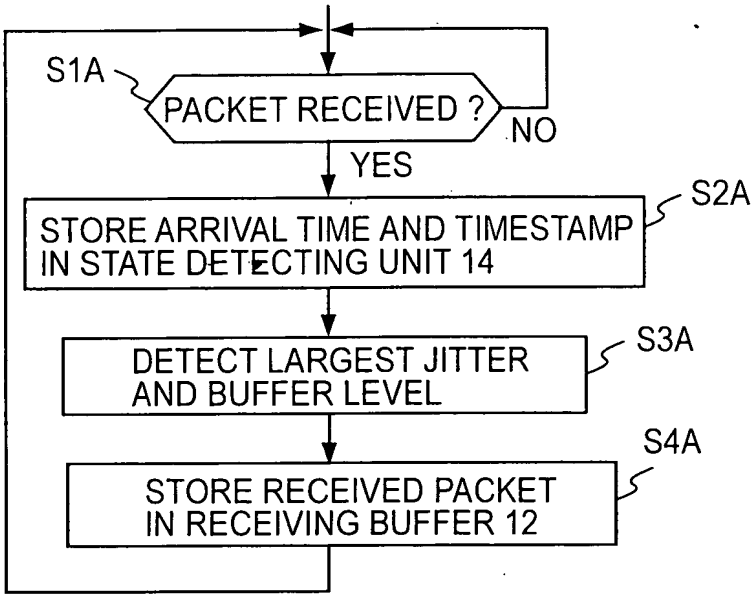

S1A
PACKET RECEIVED ?
NO
YES
S2A
STORE ARRIVAL TIME AND TIMESTAMP IN STATE DETECTING UNIT 14
S3A
DETECT LARGEST JITTER AND BUFFER LEVEL
S4A
STORE RECEIVED PACKET IN RECEIVING BUFFER 12

FIG. 5A

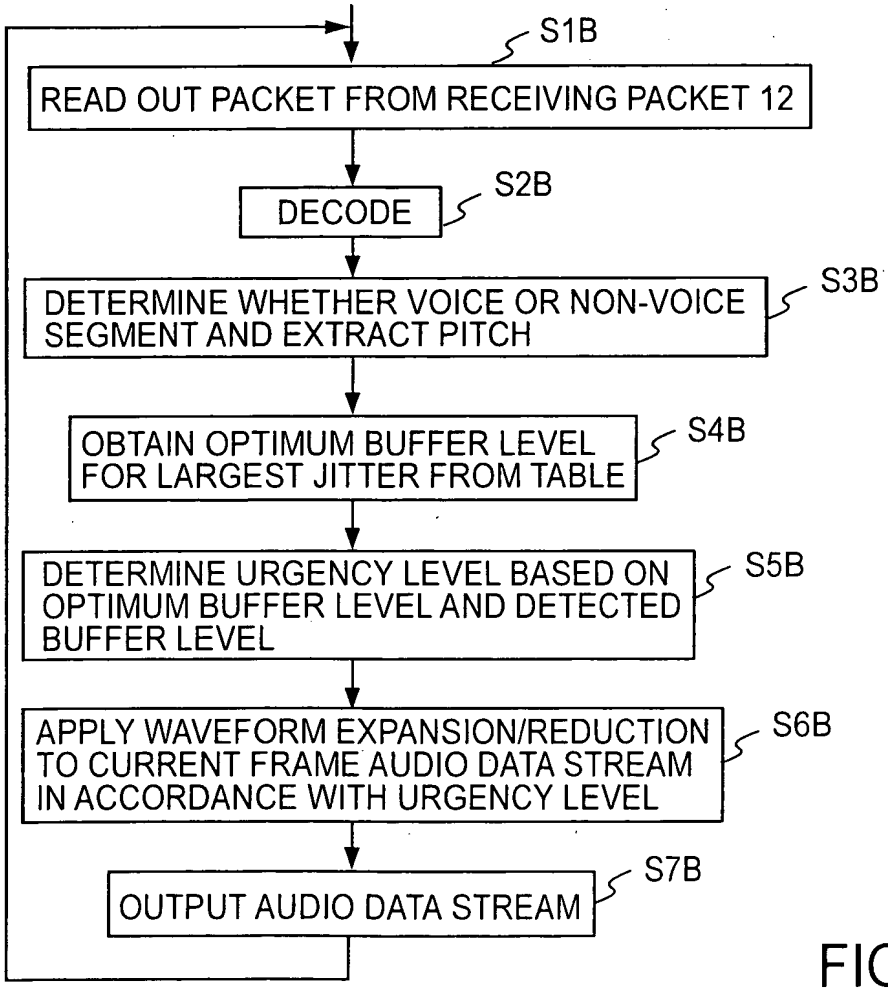

S1B
READ OUT PACKET FROM RECEIVING PACKET 12
S2B
DECODE
S3B
DETERMINE WHETHER VOICE OR NON-VOICE SEGMENT AND EXTRACT PITCH
S4B
OBTAIN OPTIMUM BUFFER LEVEL FOR LARGEST JITTER FROM TABLE
S5B
DETERMINE URGENCY LEVEL BASED ON OPTIMUM BUFFER LEVEL AND DETECTED BUFFER LEVEL
S6B
APPLY WAVEFORM EXPANSION/REDUCTION TO CURRENT FRAME AUDIO DATA STREAM IN ACCORDANCE WITH URGENCY LEVEL
S7B
OUTPUT AUDIO DATA STREAM

FIG. 5B

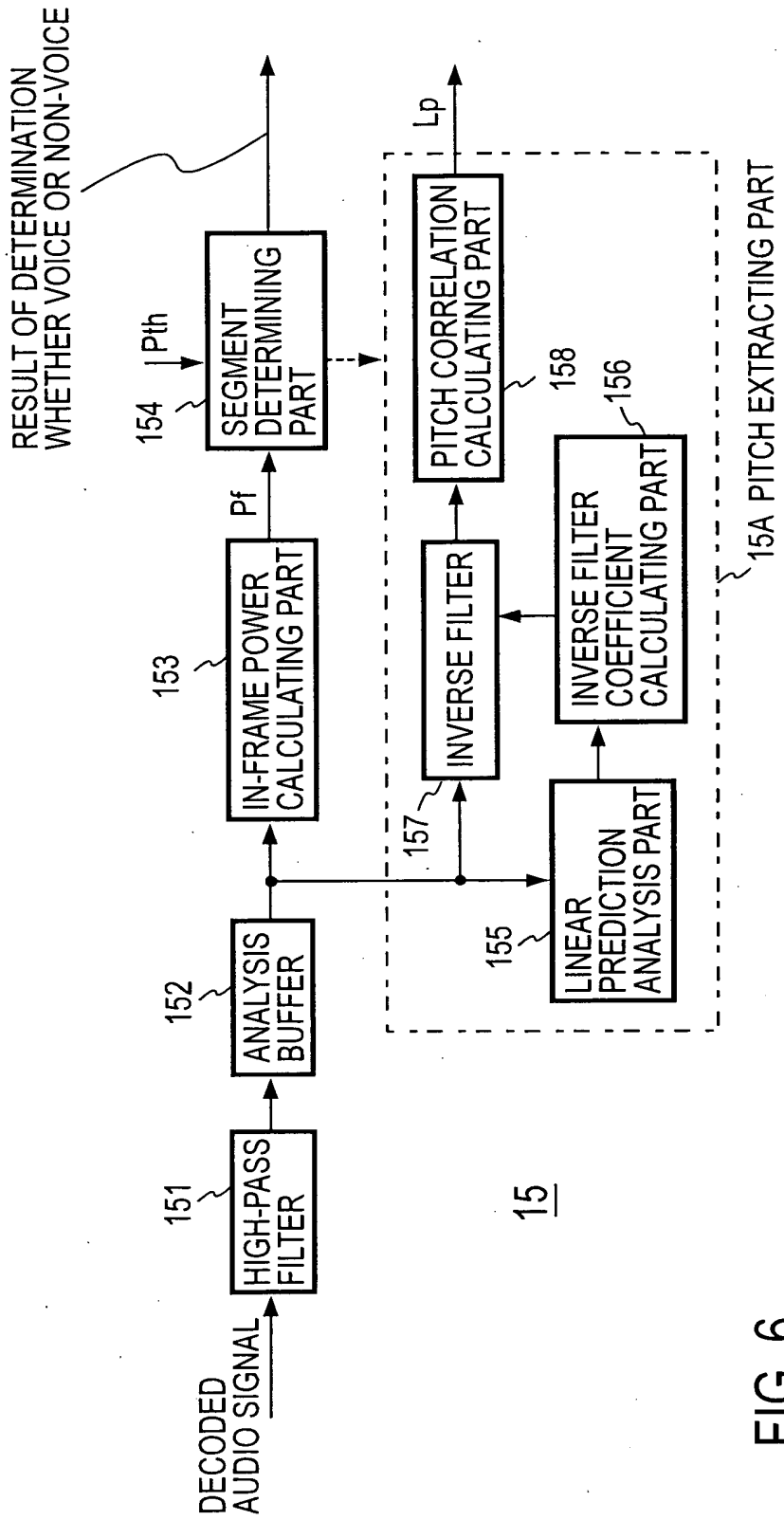

DECODED AUDIO SIGNAL
HIGH-PASS FILTER
151
ANALYSIS BUFFER
152
IN-FRAME POWER CALCULATING PART
153
Pf
SEGMENT DETERMINING PART
154
Pth
RESULT OF DETERMINATION WHETHER VOICE OR NON-VOICE
LINEAR PREDICTION ANALYSIS PART
155
INVERSE FILTER COEFFICIENT CALCULATING PART
156
INVERSE FILTER
157
PITCH CORRELATION CALCULATING PART
158
Lp
15A PITCH EXTRACTING PART
15

FIG. 6

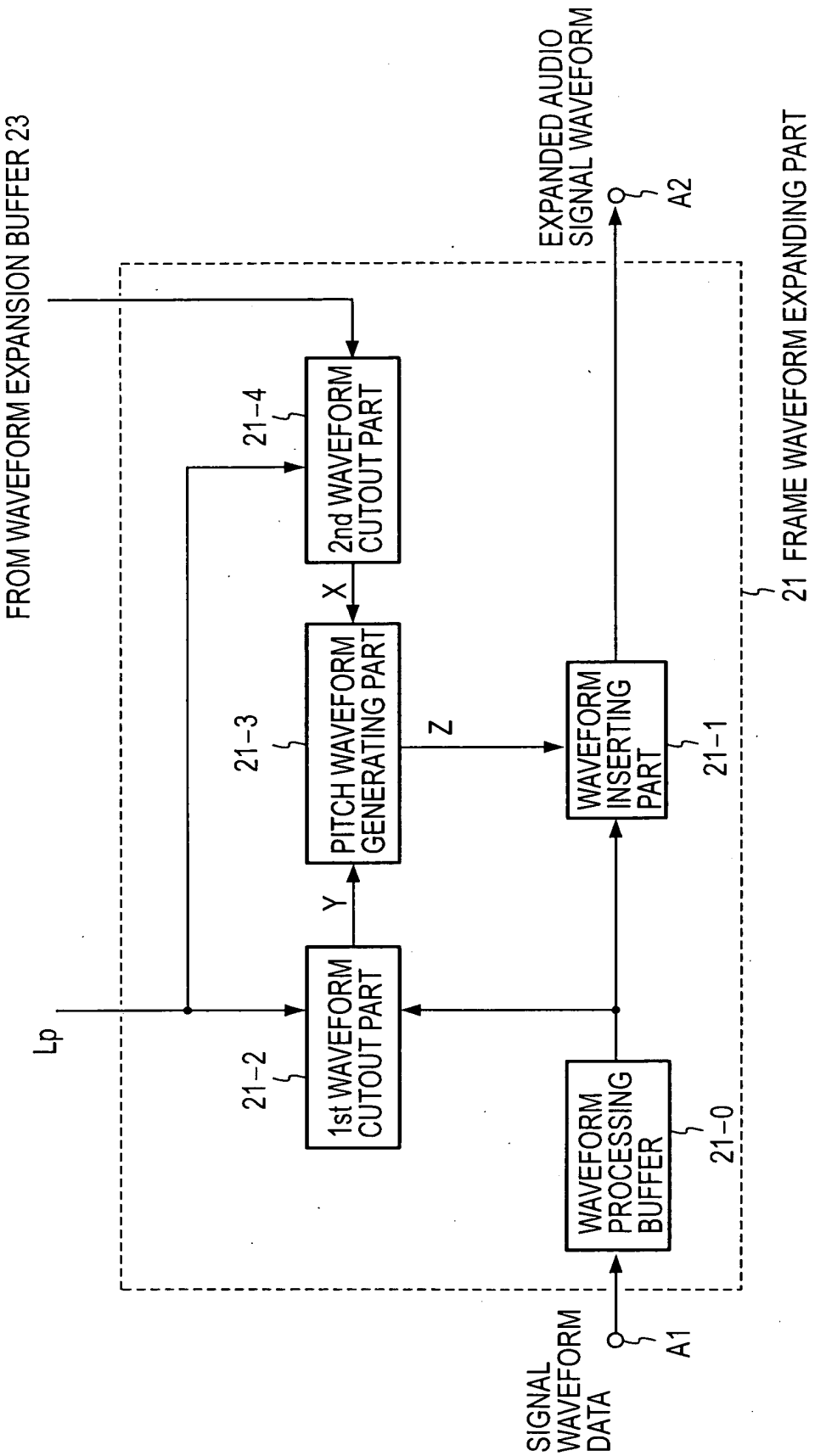

FROM WAVEFORM EXPANSION BUFFER 23
EXPANDED AUDIO SIGNAL WAVEFORM
A2
21 FRAME WAVEFORM EXPANDING PART
21-4
2nd WAVEFORM CUTOUT PART
X
21-3
PITCH WAVEFORM GENERATING PART
Z
WAVEFORM INSERTING PART
21-1
Lp
21-2
1st WAVEFORM CUTOUT PART
Y
WAVEFORM PROCESSING BUFFER
21-0
SIGNAL WAVEFORM DATA
A1

FIG. 7

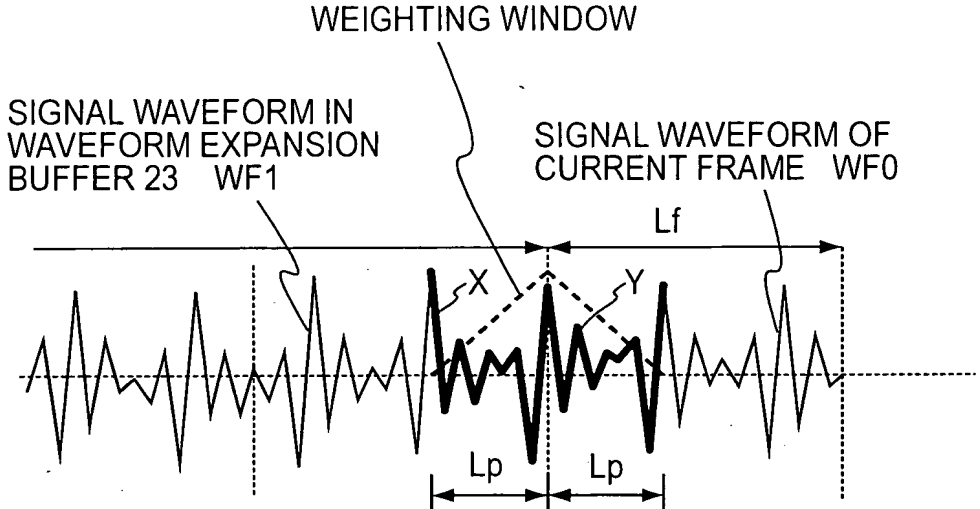


FIG. 8A

FIG. 8B WAVEFORM Z OF 1 PITCH LENGTH Lp GENERATED FROM X AND Y

FIG. 8C

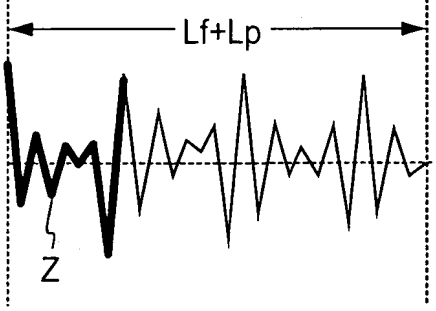


FIG. 8D EXPANDED AUDIO SIGNAL WAVEFORM

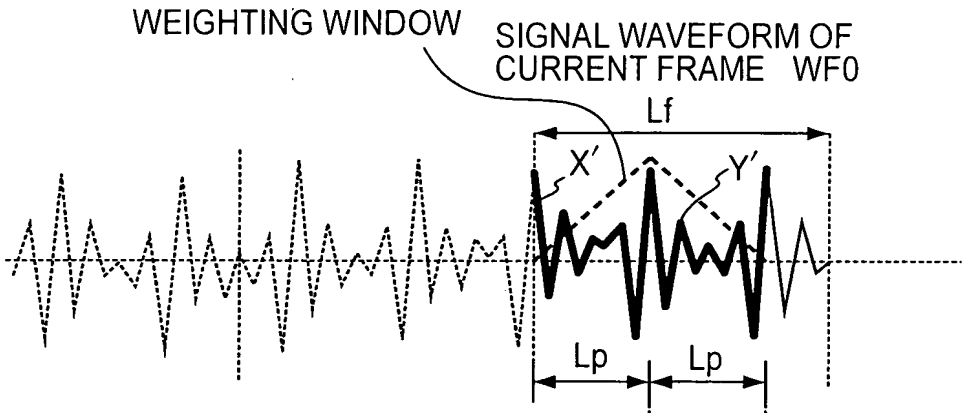


FIG. 9A

FIG. 9B WAVEFORM Z' OF PITCH LENGTH Lp GENERATED FROM X' AND Y'

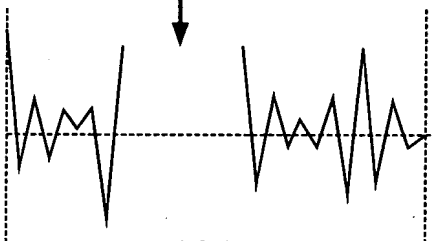


FIG. 9C

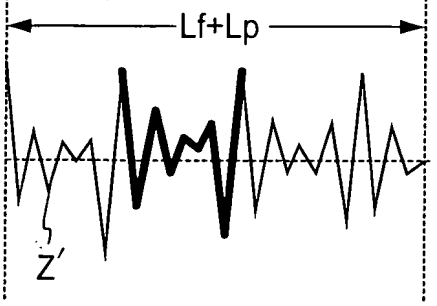


FIG. 9D EXPANDED AUDIO SIGNAL WAVEFORM

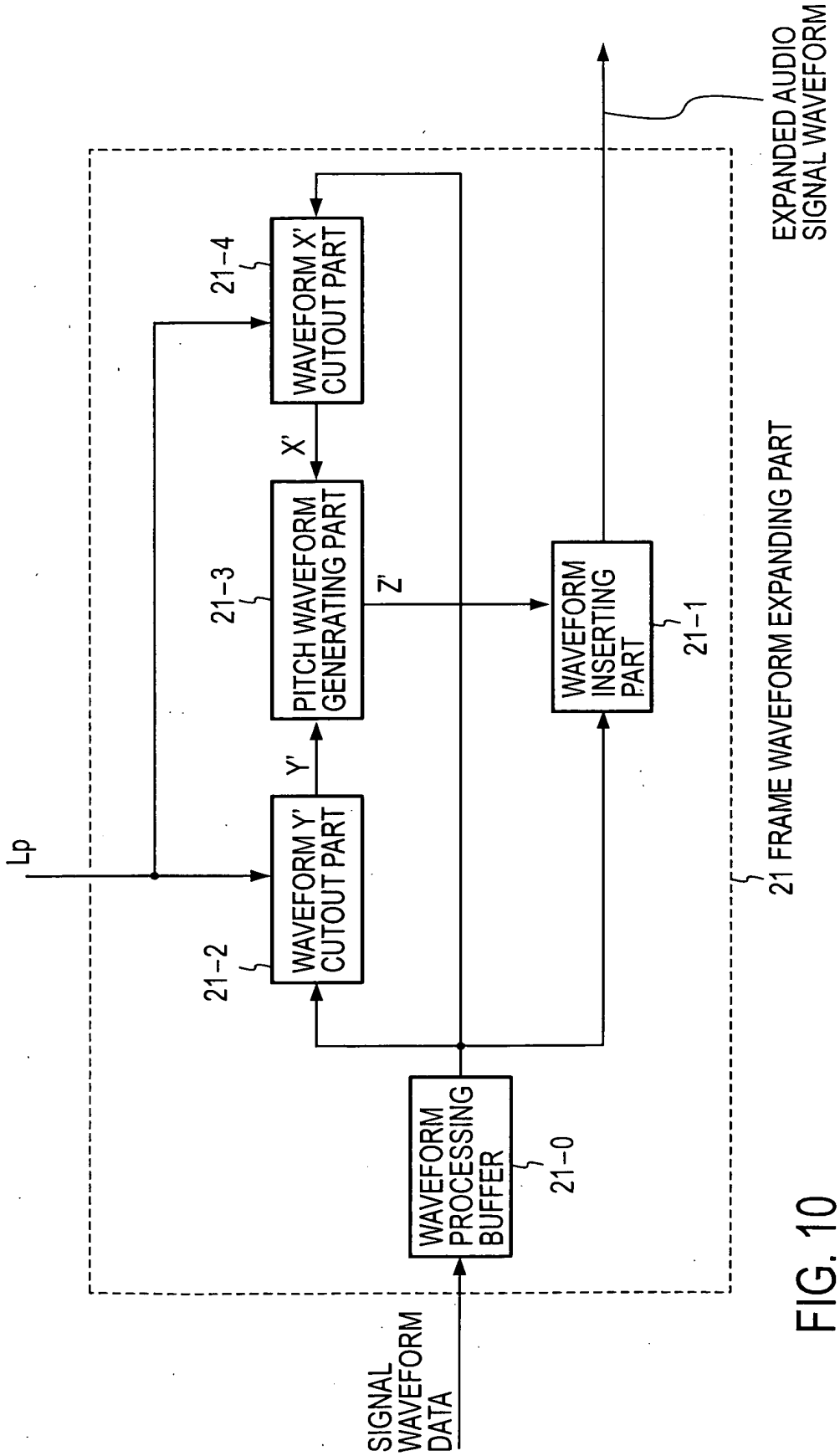

EXPANDED AUDIO SIGNAL WAVEFORM
21 FRAME WAVEFORM EXPANDING PART
Lp
WAVEFORM Y' CUTOUT PART
21-2
Y'
PITCH WAVEFORM GENERATING PART
21-3
X'
WAVEFORM X' CUTOUT PART
21-4
Z'
WAVEFORM INSERTING PART
21-1
WAVEFORM PROCESSING BUFFER
21-0
SIGNAL WAVEFORM DATA

FIG. 10

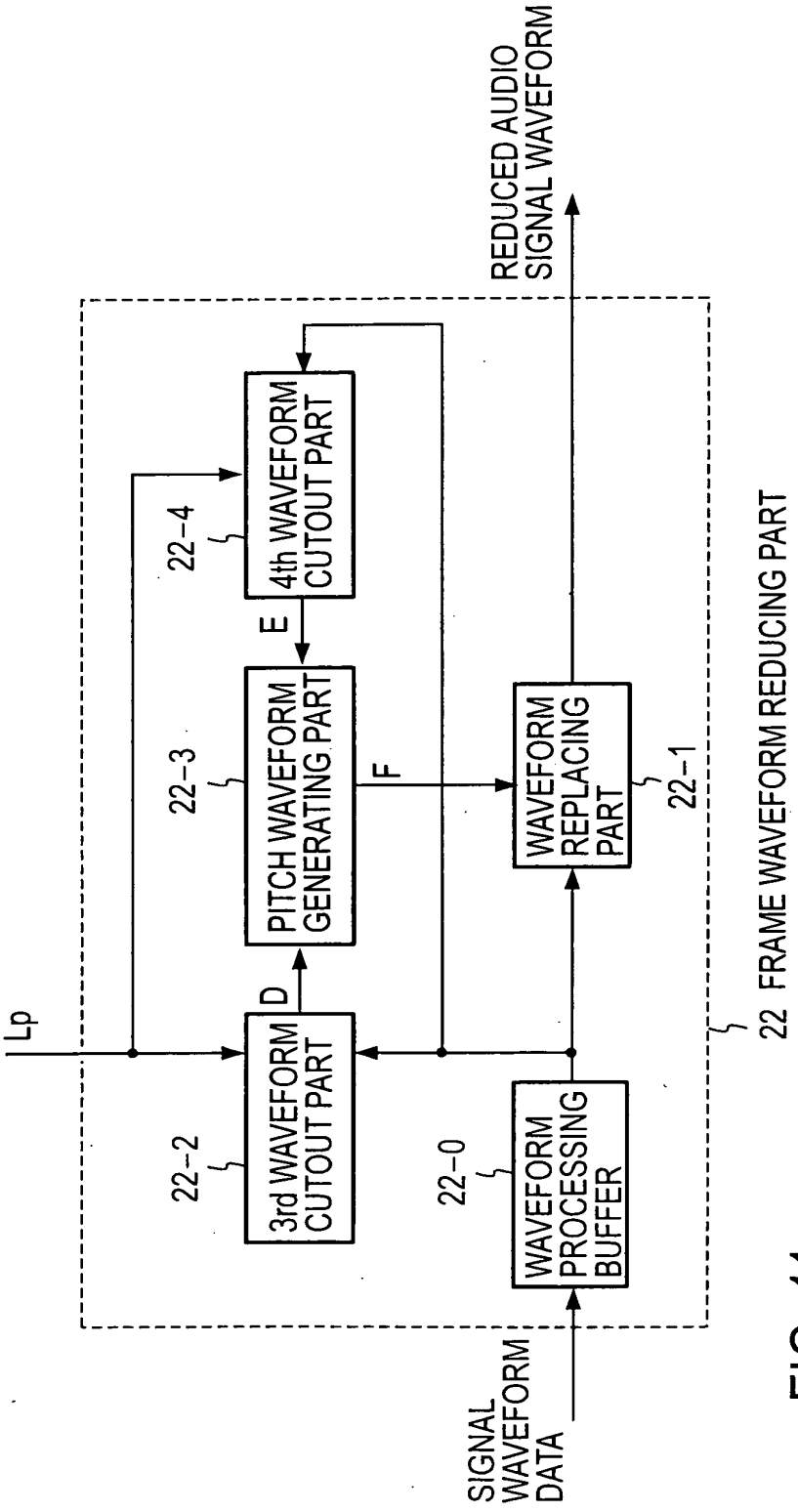

REDUCED AUDIO SIGNAL WAVEFORM
4th WAVEFORM CUTOUT PART
22-4
E
PITCH WAVEFORM GENERATING PART
22-3
F
WAVEFORM REPLACING PART
22-1
Lp
D
3rd WAVEFORM CUTOUT PART
22-2
22-0
WAVEFORM PROCESSING BUFFER
22 FRAME WAVEFORM REDUCING PART
SIGNAL WAVEFORM DATA

FIG. 11

FIG. 12A

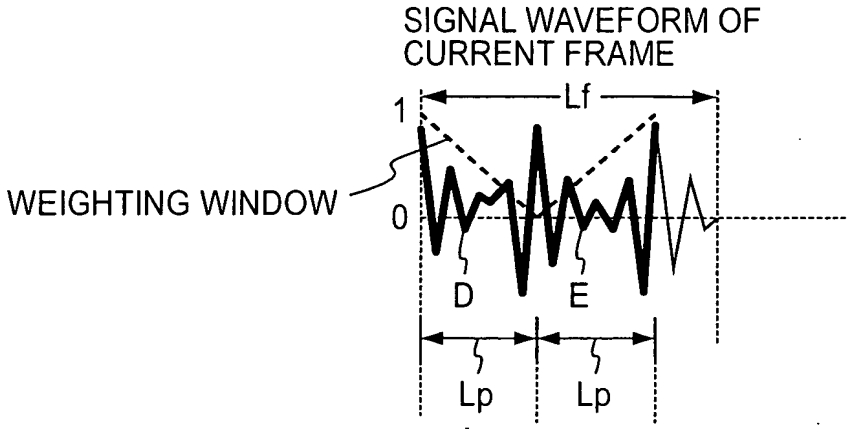


FIG. 12B

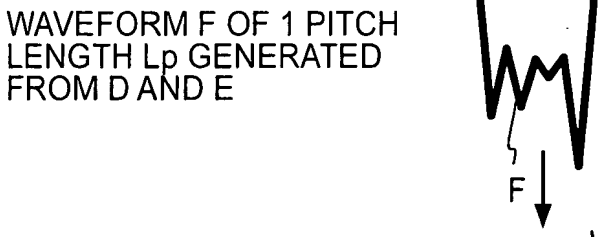


FIG. 12C

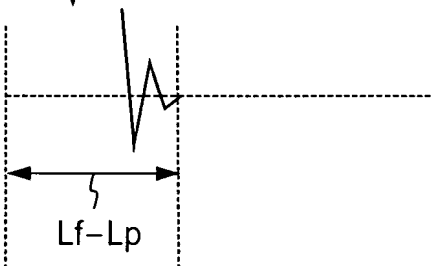
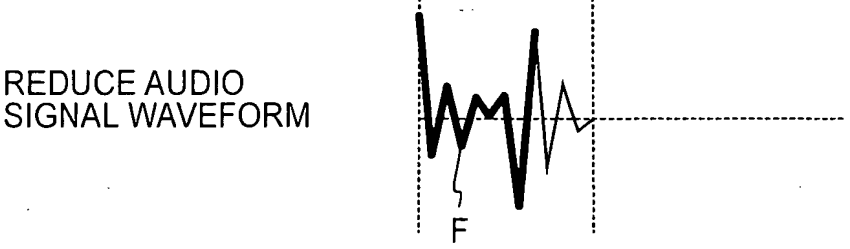


FIG. 12D



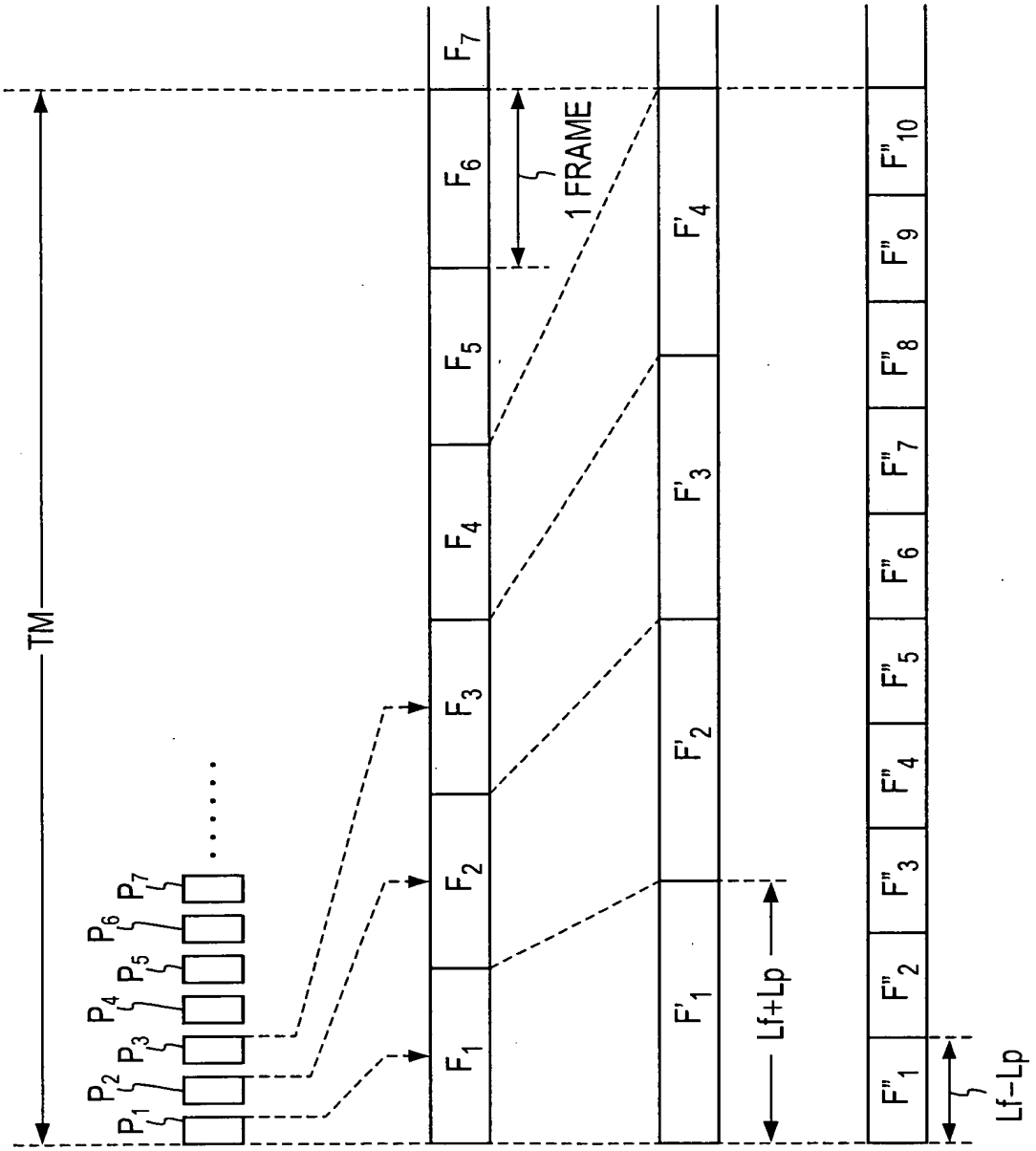


FIG. 13A PACKETS IN RECEIVING BUFFER

FIG. 13B NORMAL CONSUMPTION STATE

FIG. 13C LOW CONSUMPTION

FIG. 13D HIGH CONSUMPTION

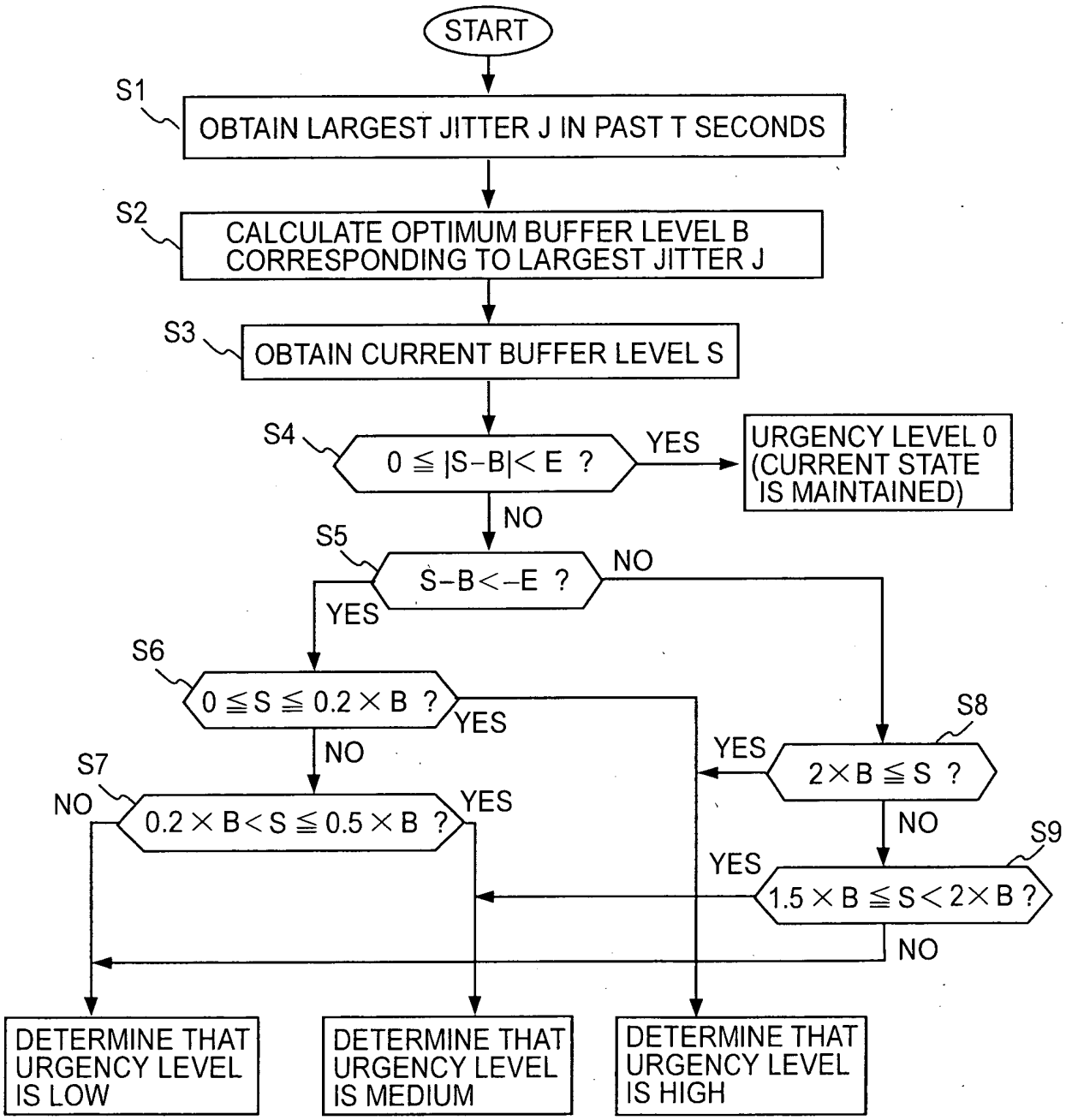

START
S1
OBTAIN LARGEST JITTER J IN PAST T SECONDS
S2
CALCULATE OPTIMUM BUFFER LEVEL B CORRESPONDING TO LARGEST JITTER J
S3
OBTAIN CURRENT BUFFER LEVEL S
S4
0 ≦ |S−B| < E ?
YES
URGENCY LEVEL 0 (CURRENT STATE IS MAINTAINED)
NO
S5
S−B < −E ?
NO
YES
S6
0 ≦ S ≦ 0.2 × B ?
YES
NO
S7
NO
0.2 × B < S ≦ 0.5 × B ?
YES
S8
YES
2 × B ≦ S ?
NO
S9
YES
1.5 × B ≦ S < 2 × B ?
NO
DETERMINE THAT URGENCY LEVEL IS LOW
DETERMINE THAT URGENCY LEVEL IS MEDIUM
DETERMINE THAT URGENCY LEVEL IS HIGH

FIG. 14

FIG. 15

TABLE 1

	VOICE SEGMENT	NON-VOICE SEGMENT
URGENCY LEVEL IS HIGH	SET TO A OR C	
URGENCY LEVEL IS MEDIUM		
URGENCY LEVEL IS LOW	FIX AT B	SET TO A OR C
URGENCY LEVEL IS 0 (CURRENT STATE IS MAINTAINED)	FIX AT B	

FIG. 16

TABLE 2

	VOICE SEGMENT	NON-VOICE SEGMENT
URGENCY LEVEL IS HIGH	SET TO A OR C	
URGENCY LEVEL IS MEDIUM		
URGENCY LEVEL IS LOW	SET TO A OR C EVERY N1-th FRAME. FIXED AT B FOR OTHER FRAMES. (N1=5, FOR EXAMPLE)	SET TO A OR C
URGENCY LEVEL IS 0 (CURRENT STATE IS MAINTAINED)	FIX AT B	

FIG. 17

TABLE 3

	VOICE SEGMENT	NON-VOICE SEGMENT
URGENCY LEVEL IS HIGH	SET TO A OR C	
URGENCY LEVEL IS MEDIUM	SET TO A OR C EVERY N2-th FRAME. FIXED AT B FOR OTHER FRAMES. (N2=2, FOR EXAMPLE)	SET TO A OR C
URGENCY LEVEL IS LOW	SET TO A OR C EVERY N1-th FRAME. FIXED AT B FOR OTHER FRAMES. (N1=5, FOR EXAMPLE)	SET TO A OR C
URGENCY LEVEL IS 0 (CURRENT STATE IS MAINTAINED)	FIX AT B	

FIG. 18

TABLE 4

	VOICE SEGMENT	NON-VOICE SEGMENT
URGENCY LEVEL IS HIGH	SET TO A OR C EVERY N3-th FRAME. FIXED AT B FOR OTHER FRAMES. (N3=1, FOR EXAMPLE)	
URGENCY LEVEL IS MEDIUM	SET TO A OR C EVERY N2-th FRAME. FIXED AT B FOR OTHER FRAMES. (N2=2, FOR EXAMPLE)	SET TO A OR C EVERY N4-th FRAME. FIXED AT B FOR OTHER FRAMES. (N4=1, FOR EXAMPLE)
URGENCY LEVEL IS LOW	SET TO A OR C EVERY N1-th FRAME. FIXED AT B FOR OTHER FRAMES. (N1=5, FOR EXAMPLE)	SET TO A OR C EVERY N5-th FRAME. FIXED AT B FOR OTHER FRAMES. (N5=2, FOR EXAMPLE)
URGENCY LEVEL IS 0 (CURRENT STATE IS MAINTAINED)	FIX AT B	

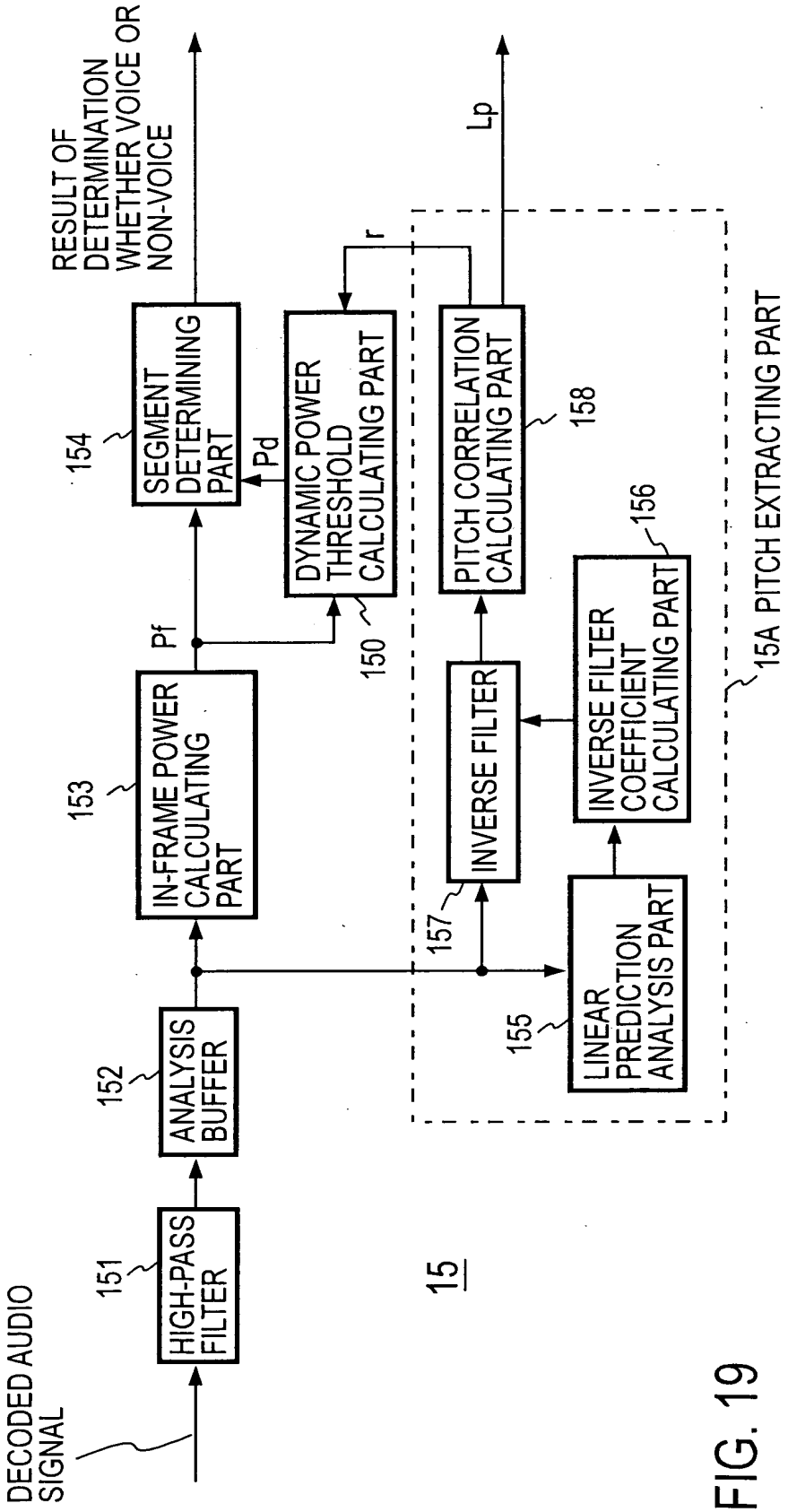

DECODED AUDIO SIGNAL
151
HIGH-PASS FILTER
152
ANALYSIS BUFFER
153
IN-FRAME POWER CALCULATING PART
154
SEGMENT DETERMINING PART
RESULT OF DETERMINATION WHETHER VOICE OR NON-VOICE
Pf
Pd
150
DYNAMIC POWER THRESHOLD CALCULATING PART
r
Lp
158
PITCH CORRELATION CALCULATING PART
156
INVERSE FILTER COEFFICIENT CALCULATING PART
157
INVERSE FILTER
155
LINEAR PREDICTION ANALYSIS PART
15A PITCH EXTRACTING PART
15

FIG. 19

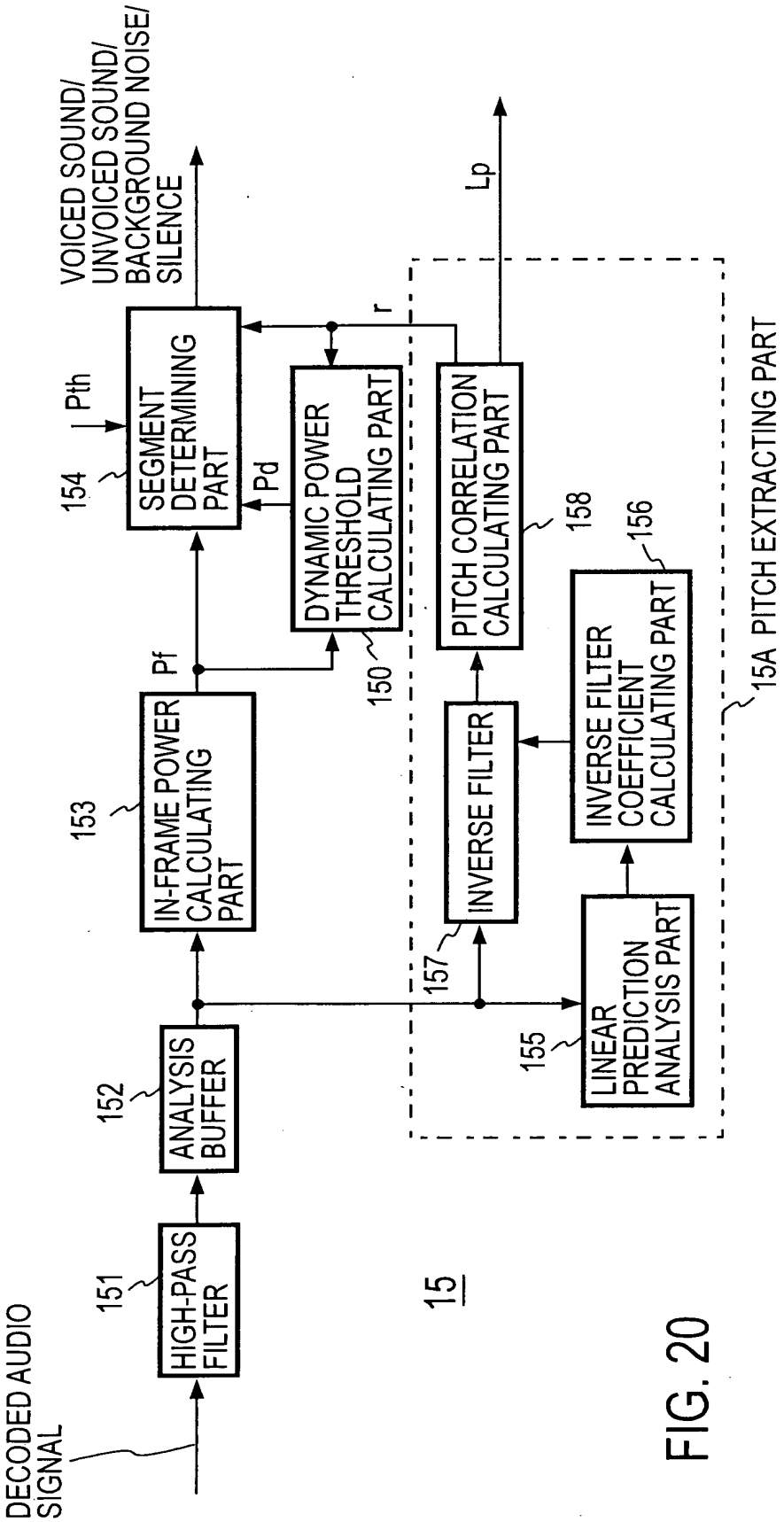

DECODED AUDIO SIGNAL
151
HIGH-PASS FILTER
152
ANALYSIS BUFFER
153
IN-FRAME POWER CALCULATING PART
Pf
154
Pth
SEGMENT DETERMINING PART
Pd
VOICED SOUND/ UNVOICED SOUND/ BACKGROUND NOISE/ SILENCE
150
DYNAMIC POWER THRESHOLD CALCULATING PART
r
Lp
158
PITCH CORRELATION CALCULATING PART
156
INVERSE FILTER COEFFICIENT CALCULATING PART
157
INVERSE FILTER
155
LINEAR PREDICTION ANALYSIS PART
15A PITCH EXTRACTING PART
15

FIG. 20

FIG. 21

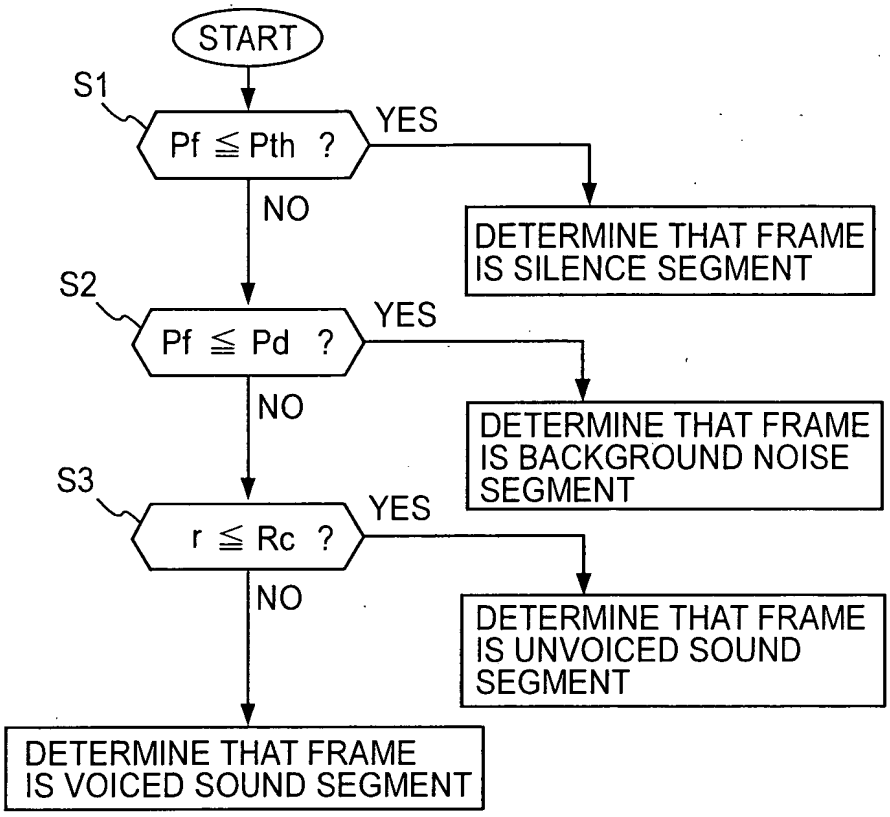


FIG. 22

TABLE 5

	VOICED SOUND SEGMENT	UNVOICED SOUND SEGMENT	BACKGROUND NOISE SEGMENT	SILENCE SEGMENT
URGENCY LEVEL IS HIGH	SET TO A OR C			
URGENCY LEVEL IS MEDIUM	EVERY N6-th FRAME	EVERY N7-th FRAME	EVERY N8-th FRAME	EVERY N9-th FRAME
URGENCY LEVEL IS LOW	EVERY N10-th FRAME	EVERY N11-th FRAME	EVERY N12-th FRAME	EVERY N13-th FRAME
URGENCY LEVEL IS 0	FIX AT B (CURRENT STATE IS MAINTAINED)			